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AUTHOR Salvatore, Gerald
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ABSTRACT

This competency-based module uses the Ocean County (New Jersey) Vocational-Technical Schools curriculum-infused model for infusing basic skills instruction into vocational education. The model demonstrates the relationship of vocational skills to communication, mathematics, and science. The document begins with a philosophy statement; preface; a table that explains the number of hours required for academic credit in various programs and the number of those hours that are devoted to basic skills and vocational activities; matrices that show in which courses specific basic skills are taught; a list of objectives; and an explanation of student activities. Most pages in the document are tables that describe the relationship of vocational skills to basic skills within the automotive and diesel engine rebuilding program. These pages are organized by instructional unit and the topics within them. For each topic and associated task(s) are listed the theories and the communications, math, and science skills covered. Also listed are the expected student outcomes. The 14 instructional units included are: orientation; shop practice; safety; fasteners; cooling system; fuel systems; measurement; engine systems; parts and organization; diesel injection fuel systems; manifolds; turbocharging and super-charging; engine overhaul; and dyno testing. (CML)

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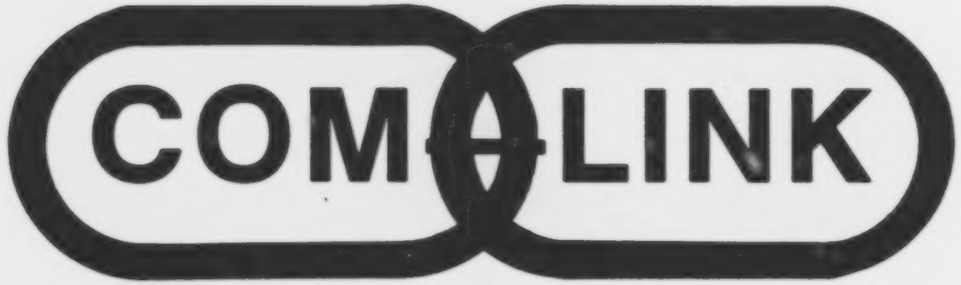
Competency Based Vocational Curricula



With Basic Skills And Academic Linkages

Dr. Frederick Felice, Project Director

Marilyn Halprin, Co Project Director (Project Coordinator)

In Cooperation With The

New Jersey State Department of Education

Division of Vocational Education

And

Ocean County Vocational-Technical School

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Ocean County Vocational-Technical School

Automotive and Diesel Engine Rebuilding

Prepared by

Gerald Salvatore, Instructor

Project Director
Frederick Felice, Ed. D., Assistant Superintendent

Project Coordinator and Editor
Marilyn Halprin, Supervisor of Basic Studies

Assistant Editor and Typist
Laura Vassallo

Administrative Offices
137 Bey Lea Road
Toms River, New Jersey 08753

William G. Henry, Superintendent

In cooperation with
the New Jersey Department of Education
Division of Vocational Education, Trenton, New Jersey 08625

PHILOSOPHY OF EDUCATION

The Ocean County Vocational-Technical Education Program should consist of those courses, activities and experiences which are designed to prepare students for a successful entrance in a given field of work. The program should be based upon an analysis of the worker needs of the field of work, the opportunities and requirements for entrance, and the particular characteristics and needs of the students.

We believe that:

The school should educate and train the students to live effectively in our ever-changing world.

The school should provide, for each student, intensive training toward general and specific job objectives, and setting standards of performance in keeping with the requirements of that particular field of work.

All students should evidence the interest, aptitude, and ability to profit from the specialized instruction, and this should be a condition of entrance into or continuance in a given field of work.

Equal attention should be given in the school program to develop sound character, good citizenship, ability to think critically, and maintain good mental and physical health.

The school must be constantly striving to fulfill its ultimate purpose; that of serving the students and the community. The school should give careful consideration to the needs, interests, and capacities of the students and the educational and technical background, experience, training, and professional interest of the professional staff as they develop a working philosophy of education.

PREFACE

The curriculum format employed by this project is competency based and utilizes the Ocean County Vocational-Technical Schools' curriculum infused model for the teaching of basic skills as part of vocational education. The design demonstrates the relationship of vocationally related skills to communication, mathematics and science knowledge. Proficiences with regard to student outcomes cannot be achieved without mastery in related academic areas. All student outcome objectives are predicated upon entry level skills which reflect the dictates of the job marketplace and industry. In addition, basic skills matrices developed by the district are included. The totality of this package is designed to facilitate the vocational teaching process and to enchance the learning experiences of our students.

POTENTIAL OPPORTUNITY FOR AWARDING ACADEMIC CREDITS FOR STUDENTS AT OCEAN COUNTY VOCATIONAL-TECHNICAL SCHOOL

450 hours - 1 year course at O.C.V.T.S.
900 hours - 2 year course at O.C.V.T.S.
1000 hours - 2 year Beauty Culture course

120 hours per year needed for 5 credits
60 hours per year needed for 2½ credits

COURSE	TOTAL HOURS	HOURS SPENT ON COMMUNICATION SKILLS	HOURS SPENT ON COMPUTATION SKILLS	HOURS SPENT ON SCIENCE	TIME ON OCCUPATIONAL ACTIVITIES IN CLASS OR SHOP
AIR CONDITIONING, REFRIGERATION AND HEATING	900	140	120	120	520
AUTO BODY REPAIR	900	130	120	125	525
AUTOMOTIVE MECHANICS	900	150	120	120	510
AUTOMOTIVE AND DIESEL ENGINE REBUILDING	900	216	126	125	433
BEAUTY CULTURE I AND II	1000	240	120	130	515
BUILDING TRADES	900	135	120	130	515
BUSINESS RELATIONS - MEDIA/MODELING	450	200	60	40	150
CHILD CARE AIDE	900	240	120	122	418
COMMERCIAL ART AND PRINTING	900	120	215	75	580
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	900	130	125	130	515

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COURSE	TOTAL HOURS	HOURS SPENT ON COMMUNICATION SKILLS	HOURS SPENT ON COMPUTATION SKILLS	HOURS SPENT ON SCIENCE	TIME ON OCCUPATIONAL ACTIVITIES IN CLASS OR SHOP
COMMERCIAL PHOTOGRAPHY & TELEVISION PRODUCTION	900	150	125	80	545
CUSTOM CABINETMAKING	900	130	120	60	590
DENTAL ASSISTING	450	168	65	77	140
DESIGN DRAFTING	900	135	150	165	450
ELECTRICAL TRADES	900	106	120	124	550
FASHION MERCHANDISING	450	200	60	40	150
FOOD SERVICES	900	206	132	125	437
INDUSTRIAL AUTOMATION AND ELECTRONICS	900	129	140	132	499
INTERIOR DESIGN	900	210	130	120	440
LANDSCAPING AND GREENHOUSE TECHNOLOGY	900	125	125	175	475

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900 hours - 2 year course at O.C.V.T.S.
1000 hours - 2 year Beauty Culture course

120 hours per year needed for 5 credits
60 hours per year needed for 2½ credits

COURSE	TOTAL HOURS	HOURS SPENT ON COMMUNICATION SKILLS	HOURS SPENT ON COMPUTATION SKILLS	HOURS SPENT ON SCIENCE	TIME ON OCCUPATIONAL ACTIVITIES IN CLASS OR SHOP
MARINE ENGINE AND BOAT SERVICES	900	164	120	125	491
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	450	173	60	77	140
MEDICAL SKILLS AND RELATED HEALTH CAREERS	450	135	65	125	125
MEDICAL SKILLS (ADVANCED)	450	125	60	125	140
PLUMBING AND HEATING	900	140	120	120	520
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	900	125	130	60	585
T.V. AND COMPUTER REPAIR	900	125	150	175	450
WELDING	900	135	120	100	545

COMMUNICATION SKILLS

Listed below are all courses offered at the Ocean County Vocational-Technical School.
The asterisk indicates that the topic is studied in that curriculum.

COURSE	Functional Reading Skills	Vocabulary	Identifying Main Ideas	Meanings in Context	Inferences	Fact/Opinion Distinction	Signal Words	Parts of Text-book/Manual	Following Directions	Outlining and Note Taking	Interpretation of Maps and Charts	Interpretation of Diagrams	Test Taking Skills	Expository Writing Skills	Problem Solving	Spelling	Oral Communications	Study Skills	Resume Writing	Job Application Skills
AIR CONDITIONING, REFRIGERATION AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AUTO BODY REPAIR	*	*		*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
AUTOMOTIVE MECHANICS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AUTOMOTIVE AND DIESEL ENGINE REBUILDING	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BEAUTY CULTURE I AND II	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BUILDING TRADES	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BUSINESS RELATIONS - MEDIA/MODELING/TRAVEL	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*
CHILD CARE AIDE	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL ART AND PRINTING CAREERS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL PHOTOGRAPHY AND TELEVISION PRODUCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
CUSTOM CABINETMAKING	*	*		*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
DENTAL ASSISTING	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*

COMMUNICATION SKILLS - CONTINUED

COURSE	Functional Reading Skills	Vocabulary	Identifying Main Ideas	Meanings in Context	Inferences	Fact/Opinion Distinction	Signal Words	Parts of Text-book/Manual	Following Directions	Outlining and Note Taking	Interpretation of Maps, Graphs and Charts	Interpretation of Diagrams	Test Taking Skills	Expository Writing Skills	Problem Solving	Spelling	Oral Communications	Study Skills	Resume Writing	Job Application Skills
DESIGN DRAFTING	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ELECTRICAL TRADES	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
FASHION MERCHANDISING	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
FOOD SERVICES	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
INDUSTRIAL AUTOMATION AND ELECTRONICS	*	*	*		*	*			*	*	*	*	*	*	*	*	*	*	*	*
INTERIOR DESIGN	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LANDSCAPING AND GREENHOUSE TECHNOLOGY	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
MARINE ENGINE AND BOAT SERVICE	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
MEDICAL SKILLS AND RELATED HEALTH CAREERS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
MEDICAL SKILLS (ADVANCED)	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
PLUMBING AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
T.V. AND COMPUTER REPAIR	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
WELDING	*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

MATHEMATICS SKILLS

Listed below are all courses offered at the Ocean County Vocational-Technical School. The asterisk indicates that the topic is studied in that curriculum.

COURSE	Whole Numbers	Common Fractions	Decimals	Percentages	Weights and Measurements	Ratio and Proportion	Powers and Roots	Formulas	Estimating	Geometry	Basic Trigonometric Functions	Graphs
AIR CONDITIONING, REFRIGERATION AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*
AUTO BODY REPAIR	*	*	*	*	*	*	*	*	*	*		*
AUTOMOTIVE MECHANICS	*	*	*	*	*	*	*	*	*			*
AUTOMOTIVE AND DIESEL ENGINE REBUILDING	*	*	*	*	*	*	*	*	*	*		*
BEAUTY CULTURE I AND II	*	*	*	*	*	*	*	*	*	*	*	*
BUILDING TRADES	*	*	*	*	*	*	*	*	*	*	*	*
BUSINESS RELATIONS - MEDIA/MODELING/TRAVEL	*		*	*		*			*			*
CHILD CARE AIDE	*	*	*	*	*	*		*	*	*	*	*
COMMERCIAL ART AND PRINTING CAREERS	*	*	*	*	*	*		*	*	*		*
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL PHOTOGRAPHY AND TELEVISION PRODUCTION	*	*	*	*	*	*	*	*	*	*	*	*
CUSTOM CABINETMAKING	*	*	*	*	*	*	*	*	*	*	*	*
DENTAL ASSISTING	*	*	*	*	*	*		*	*			*

MATHEMATICS SKILLS - CONTINUED

COURSE	Whole Numbers	Common Fractions	Decimals	Percentages	Weights and Measurements	Ratio and Proportion	Powers and Roots	Formulas	Estimating	Geometry	Basic Trigonometric Functions	Graphs
DESIGN DRAFTING	*	*	*	*	*	*		*	*	*	*	*
ELECTRICAL TRADES	*	*	*	*	*	*	*	*	*	*	*	*
FASHION MERCHANDISING	*	*	*	*	*	*		*	*	*		*
FOOD SERVICES	*	*	*	*	*	*		*	*	*		*
INDUSTRIAL AUTOMATION AND ELECTRONICS	*	*	*	*	*	*		*	*	*	*	*
INTERIOR DESIGN	*	*	*	*	*	*		*	*	*		*
LANDSCAPING AND GREENHOUSE TECHNOLOGY	*	*	*	*	*	*		*	*	*	*	*
MARINE ENGINE AND BOAT SERVICE	*	*	*	*	*	*		*			*	*
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	*	*	*	*	*	*	*	*	*	*		*
MEDICAL SKILLS AND RELATED HEALTH CAREERS	*	*	*	*	*	*		*	*	*	*	*
MEDICAL SKILLS (ADVANCED)	*	*	*	*	*	*		*	*	*	*	*
PLUMBING AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	*	*	*	*	*	*	*	*			*	*
T.V. AND COMPUTER REPAIR	*	*	*	*	*	*	*	*		*	*	*
WELDING	*	*	*	*	*	*		*	*	*	*	*

SCIENCE SKILLS

Listed below are all courses offered at the Ocean County Vocational-Technical School. Those listed as "Not Available" do not offer enough hours to qualify for credits in your high school. However, we have noted the skills covered. Those listed with an asterisk after the title are eligible. The asterisk indicates that the topic is studied in that curriculum.

	HUMAN ANATOMY						ASTRONOMY			CHEMISTRY			PHYSICS					ECOLOGY				
COURSE	Cellular Theory	Skeletal System	Muscles	System of Body	Diseases	Psychology	Solar System	Gravity	Weather	Matter	Chemical Reactions	Applied Chemistry	Light	Magnetism	Heat	Magnetism and Electricity	Nuclear Energy	Botany	Food Production	Fuels	Nutrition	Waste Disposal
AIR CONDITIONING, REFRIGERATION AND HEATING							*	*	*	*	*	*		*	*	*				*	*	
AUTO BODY REPAIR								*	*	*	*	*	*	*	*					*		*
AUTOMOTIVE MECHANICS								*		*	*	*	*	*	*	*				*		
AUTOMOTIVE DIESEL AND ENGINE REBUILDING								*		*	*	*		*	*	*	*			*		*
BEAUTY CULTURE I AND II	*	*	*	*	*	*				*	*	*	*		*	*					*	
BUILDING TRADES							*	*	*	*	*	*	*		*	*		*		*		
BUSINESS RELATIONS - MEDIA/MODELING/TRAVEL	N	* O	* T	* A	V	* A	I	L	A	B	L	E										
CHILD CARE AIDE	*	*	*	*	*	*			*		*	*		*	*			*	*		*	*
COMMERCIAL ART AND PRINTING CAREERS	N	O	T	A	V	A	I	* L	A	* B	* L	* E	*		*	*						*
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*		*		*	*	*
COMMERCIAL PHOTOGRAPHY AND TELEVISION PRODUCTION	N	O	T	A	V	* A	I	* L	A	* B	* L	* E	*		*	*						*
CUSTOM CABINETMAKING	* N	O	T	A	V	A	I	* L	A	* B	* L	* E			*			*				
DENTAL ASSISTING	*	*	*	*	*	*				*	*	*	*								*	*

SCIENCE SKILLS - CONTINUED

COURSE	HUMAN ANATOMY						ASTRONOMY			CHEMISTRY			PHYSICS					ECOLOGY				
	Cellular Theory	Skeletal System	Muscles	System of Body	Diseases	Psychology	Solar System	Gravity	Weather	Matter	Chemical Reactions	Applied Chemistry	Light	Magnetism	Heat	Magnetism and Electricity	Nuclear Energy	Botany	Food Production	Fuels	Nutrition	Waste Disposal
DESIGN DRAFTING							*	*	*	*		*	*		*	*	*			*		*
ELECTRICAL TRADES							*	*	*	*	*		*	*	*	*	*		*			
FASHION MERCHANDISING	*	*	*	*		*		*		*	*	*	*								*	
FOOD SERVICES					*	*		*	*		*	*	*		*				*		*	*
INDUSTRIAL AUTOMATION AND ELECTRONICS								*		*			*	*	*	*	*			*		
INTERIOR DESIGN		*	*			*	*	*	*	*	*	*	*		*	*						*
LANDSCAPING AND GREENHOUSE TECHNOLOGY							*	*	*		*	*	*		*	*		*	*	*	*	*
MARINE ENGINE AND BOAT SERVICE								*	*	*	*	*	*	*	*	*		*		*		
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	N	* O	* T	* A	* V	* A	I	L	A	B	* L	E										*
MEDICAL SKILLS AND RELATED HEALTH CAREERS	*	*	*	*	*	*		*		*	*					*			*		*	*
MEDICAL SKILLS (ADVANCED)	*	*	*	*	*	*		*		*	*					*			*		*	*
PLUMBING AND HEATING					*		*	*	*	*	*	*			*	*		*		*		*
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	N	O	T	A	V	A	I	* L	A	* B	* L	* E	*	*	*	*				*		*
T.V. AND COMPUTER REPAIR										*	*	*	*	*	*	*				*		
WELDING								*		*	*	*	*	*	*	*				*		

COURSE OBJECTIVES

1. To prepare students with entry level skills, abilities and knowledge for employment in the automotive and diesel engine rebuilding trade.

2. To present 900 hours of instruction and practice in the automotive and diesel engine rebuilding trade in accordance with the course curriculum and skill profile outline.

3. To provide a detailed summary evaluation of the proficiency achieved by each student representing the most important content areas presented in the automotive and diesel engine rebuilding trade skill profile.

4. To help each student develop positive attitudes and ideals related to their occupation in the automotive diesel and engine rebuilding trade and understand their own capabilities and potential.

5. To instill in each student the need to plan for their professional growth through continuous learning in their chosen occupation.

STUDENT ACTIVITIES

All students enrolled in the Ocean County Vocational-Technical School are encouraged to join Vocational Industrial Clubs of America (VICA). Student activities are infused into each program. Each building has a student government and a student activities program separate from VICA. Additionally, students from each center and every class are encouraged to participate in the VICA Leadership and Job Demonstration Contests which begin in the centers and radiate throughout the district as Ocean County Vocational-Technical School inter school winners are chosen.

Student activities emphasize the basic precepts of VICA, as well as the basic tenets of democracy. Within the context, each of our programs teaches the dignity of work, high standards in trade ethics and safety, and a belief in the free enterprise economic system.

TABLE OF CONTENTS

AUTOMOTIVE ENGINE REBUILDING/DIESEL

PHILOSOPHY OF EDUCATION..... i
PREFACE..... ii
POTENTIAL OPPORTUNITY FOR AWARDING ACADEMIC CREDITS..... iii
COMMUNICATION SKILLS..... vi
MATHEMATICS SKILLS..... viii
SCIENCE SKILLS..... x
COURSE OBJECTIVES..... xii
STUDENT ACTIVITIES..... xiii
ORIENTATION..... 1
SHOP PRACTICE..... 2
SAFETY..... 3
FASTENERS..... 6
COOLING SYSTEM..... 7
FUEL SYSTEMS..... 8
MEASUREMENT..... 12
ENGINE SYSTEMS..... 13
- Cylinder Head..... 15
- Valve Train..... 18
- Engine Blocks..... 20
- Crankshafts..... 22
- Engine Bearings..... 23
- Connecting Rods..... 24
- Piston, Pins and Rings..... 25
- Gaskets..... 27

PARTS AND ORGANIZATION..... 28
- Shipping and Receiving..... 28

DIESEL INJECTION FUEL SYSTEMS..... 29

MANIFOLDS..... 30
- Intake Manifolds..... 30
- Exhaust Manifolds..... 31

TURBOCHARGING AND SUPERCHARGING..... 32

ENGINE OVERHAUL..... 33
- Disassembly..... 33
- Cleaning..... 34
- Engine Measurement..... 35
- Engine Block (Gasoline)..... 36
- Engine Block (Diesel)..... 37
- Cylinder Honing..... 38
- Block Decking..... 39
- Crankshafts..... 40
- Block Main Saddles..... 41
- Connecting Rod Reconditioning..... 42
- Cylinder Heads..... 43
- Lower Engine Assembly..... 48
- Upper Engine Assembly..... 51
- Pre-Start Checks..... 52
- Post Start Checks..... 53

DYNO TESTING..... 54

UNIT: ORIENTATION - AUTOMOTIVE ENGINE REBUILDING/DIESEL

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Identifying and analyzing school policies and rules	A. Instructional units B. Grading system C. Student personal system D. Fire drill procedure E. Student handbook F. Job description G. General safety H. Discipline forms I. Cooperative Industrial Education (C.I.E) J. Vocational Industrial Clubs of America (VICA) K. Resume and job application L. Orientation quiz	A. Oral communication B. Writing skills C. Functional reading skills D. Vocabulary E. Following directions F. Test taking skills	A. Whole numbers B. Decimals C. Metric system D. Percentages	A. Flammable, toxic and volitive chemicals B. Toxic fumes resulting from a fire	A. The student will be able to delineate the units of instruction B. The student will be able to describe the grading system C. The student will be able to demonstrate a safe and orderly exit in the event of a fire D. The student will be able to interpret the student handbook E. The student will be able to describe the role of an engine rebuilder F. The student will be able to delineate the general safety regulations G. The student will be able to describe the C.I.E. program H. The student will be able to define VICA and explain its function I. The student will be able to prepare a resume J. The student will be able to complete a job application K. The student will be able to complete the orientation quiz with 70% accuracy

UNIT: SHOP PRACTICE

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Shop work and using shop manuals	A. Specifications B. Ten steps of engine rebuilding C. Engine parts catalogues D. Engine specification books E. Engine service books F. Job work sheets G. Flat rate and parts cost sheets H. Computer cost programs (parts)	A. Functional reading skills B. Vocabulary C. Parts of textbook manual D. Following directions E. Outlining and note taking F. Interpretation of graphs and charts G. Interpretation of diagrams and codes H. Spelling I. Troubleshooting J. Oral communication K. Test taking skills	A. Whole numbers B. Common fractions C. Decimals D. Weights and measurements E. Ratio and proportion F. Metric system and measurement		A. The student will be able to define specification B. The student will be able to list the ten steps of engine rebuilding C. The student will be able to demonstrate the use of parts catalogues D. The student will be able to demonstrate the use of specification and service books E. The student will be able to complete a job work sheet F. The student will be able to demonstrate the use of flat rate and parts cost sheets G. The student will be able to demonstrate the use of computer parts cost programs

UNIT: SAFETY

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Demonstrate a knowledge of safe working habits, attitude and proper shop procedure	A. Knowledge of shop layout B. Location of safety devices C. Fire drill procedures and exits D. Identification of hazards in the work area	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills		A. Chemical reactions B. Heat C. Fuels D. Waste disposal	A. The student will be able to demonstrate an ability to perform in a manner that will protect him/her and others in the shop B. The student will be able to pass a written safety test with a score of 100%
II. Proper use of hand tools	A. Proper selection of the correct hand tool for the job B. Safe and correct use of hand tools	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Parts of textbook/manual E. Following directions F. Outlining and note taking G. Test taking skills H. Writing skills I. Problem solving J. Spelling K. Oral communication L. Study skills	A. Whole numbers B. Common fractions C. Metric conversion D. Torque		The student will be able to display sufficient knowledge of proper hand tool use by passing a performance test

UNIT: SAFETY - CONTINUED

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
III. Using shop machines safely	Safety 1. Grinders 2. Drill press 3. Value equipment 4. Boring bar 5. Surface grinder 6. Honing equipment 7. Magna flux 8. Pressure testor 9. Head shop 10. Hydraulic press	A. Functional reading skills B. Vocabulary C. Following directions D. Oral communications E. Note taking skills F. Test taking skills	A. Common fractions B. Measurement C. Metric system		A. The student will be able to identify as to correct name, function and use of all machinery in the lab B. The student will be able to delineate all machine safety rules using the information sheet provided C. The student will be able to complete the safety examination for each machine D. The student will be able to demonstrate use of each machine discussed in class
IV. Using shop cleaning equipment safely	Safety 1. Steam jenny 2. Power washer 3. High pressure hot tank 4. Bead blaster 5. Solvent tanks 6. Ultra-sonic tank	A. Vocabulary B. Following directions C. Problem solving D. Functional reading skills E. Oral communications F. Note taking skills G. Test taking skills	A. Whole numbers B. Weights and measurements	A. Heat B. Flammable, toxic and volitile chemicals C. Chemical reactions D. Waste disposal	A. The student will be able to pass a cleaning equipment safety test with a score of 100% B. The student will be able to display sufficient knowledge of chemical mixtures used in cleaning equipment by passing a performance test C. The student will be able to display sufficient knowledge of procedures in using equipment by passing a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
V. Safe and proper use of jacks, hoists, and jackstands	Proper procedure in using various types of lifting and support devices is essential to protect students and equipment	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Signal words E. Parts of textbook/manual F. Following directions G. Outlining and note taking H. Test taking skills I. Writing skills J. Problem solving K. Spelling L. Oral communication M. Study skills	Weights and measurement	A. Many of the tools and equipment in the auto shop operate on the principles of pneumatics, compressed air and hydraulics and compressed liquids B. A basic knowledge of these principles is important to the safe operation of shop equipment	The student will be able to demonstrate a knowledge of safe and proper use of lifting equipment by passing a performance test

UNIT: FASTENERS

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Identify the various types of automotive fasteners and their functions	A. There are many types of fasteners with specific and limited functions B. It is necessary to properly identify these fasteners, their functions, capabilities and limitations	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Note taking skills F. Test taking skills G. Writing skills H. Problem solving I. Spelling J. Oral communication K. Study skills	A. Whole numbers B. Common fractions C. Metric conversion D. Torque	Metallurgy 1. The student must have a working knowledge of the different types of steel and other materials used in automotive fasteners so a fastener that is needed in a critical location is of the proper tensile strength 2. Different metals react to each other in different ways and an engine builder must be aware of this	The student will be able to demonstrate identification of common fasteners by passing a written test

UNIT: COOLING SYSTEM

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the purpose and the operation of an automobile cooling system II. Describe the function and operation of the individual components of the cooling system III. Pressure test a cooling system and radiator pressure cap IV. Inspect all components of the cooling system for proper operation V. Remove and replace thermostat, refill and pressure test system	A. An internal combustion engine produces a great amount of heat which must be carried away by the cooling system in order to insure proper engine operation B. There are several individual components of the automobile engine cooling system that operate together to provide efficient engine cooling C. Automotive cooling systems operate at higher than atmospheric pressure D. The system must be able to withstand this pressure or system failure will result E. The components of an automotive cooling system eventually wear which will render them inoperable F. Periodic inspection is necessary to maintain proper system operation G. The cooling system thermostat regulates the temperature at which coolant flows through an engine H. Proper temperature control is essential to the proper operation of the engine	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Signal words E. Parts of textbook/manual F. Following directions G. Outlining and note taking H. Test taking skills I. Writing skills J. Problem solving K. Spelling L. Oral communication M. Study skills	A. Whole numbers B. Percentages C. Decimals D. Common fractions E. Ratio and proportion F. Measurement	A. Heat B. Atmospheric pressure 1. Water boils at 212° Fahrenheit at sea level where atmospheric pressure is 14.7 psi 2. For every pound of pressure above that at sea level, the boiling point of water is raised 3° 3. Cooling systems are pressurized to ensure the coolant will remain a liquid, enabling it to still carry away heat without turning to steam, which cannot carry away heat	A. The student will be able to demonstrate a knowledge of cooling system operation by passing a written test B. The student will be able to identify the components of an automobile engine cooling system as demonstrated by passing a written test C. The student will be able to perform a cooling system pressure test with a moderate degree of skill as demonstrated by a performance test D. The student will be able to inspect components of a cooling system for wear as indicated by a performance test E. The student will be able to demonstrate a knowledge of cooling system operation by passing a written test

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Identify and describe the characteristics of gasoline and diesel motor fuels II. Visually identify and describe the parts of a basic fuel system on a vehicle III. Explain the operation of a carburetor IV. Explain the function of a fuel pump in an automotive fuel system	A. Fuels used in automotive engines include petroleum fuels 1. Gasoline 2. Diesel fuel 3. Propane 4. Butane B. Alcohol type fuels can also be used C. A basic fuel system consists of certain components 1. Fuel tank 2. Connecting lines 3. Fuel pump 4. Fuel filter 5. Air filter 6. Fuel metering and atomization system D. A carburetor is a vacuum operated device that supplies a fine spray of gasoline into the incoming air stream E. The amount of gasoline is proportional to the amount of air drawn through the barrel of the carburetor F. The barrel is the throat opening or "throttle bore" G. The amount of air that passes through the carburetor can be controlled by operating a moveable valve called a "throttle plate" in an opening at the bottom of the carburetor bore H. A mechanical or electrical fuel pump is used to draw fuel from the fuel tank and deliver it to the carburetor or fuel injection system	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Percentages B. Measurement C. Decimals	A. Chemical reactions Due to the combustion process that takes place in the engine, various by-products are formed a. water b. carbon monoxide c. sulfur compounds d. others B. Fuels C. Vacuum A state of air pressure below that of atmospheric pressure	A. The student will be able to identify and describe the characteristics of automotive fuels by passing a written test B. The student will be able to identify the parts of a basic fuel system by passing a written test and by achieving a moderate level of skill on a performance test C. The student will be able to demonstrate the ability to explain the operation of a carburetor by passing a written test D. The student will be able to describe the operation of a fuel pump by passing a written test

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
V. Explain the difference between difficult types of fuel injection systems VI. Practice fuel system safety VII. Replace a gasoline fuel pump VIII. Explain the basic processes that are involved in carburetion	A. Electronic fuel injection systems perform exactly the same function as a carburetor B. It provides a range of air-fuel mixtures which allows the engine to run properly and efficiently at widely varying speeds, loads and temperatures C. Working around fuel systems can be hazardous D. Perform fuel system service only in well ventiliated areas E. Familiarize yourself with the location of shop fire extinguishers before beginning such work F. Modern fuel pumps are not repairable; they must be replaced if faulty G. Carburetion means enriching a gas (usually air), by combining it with a carbon containing compound (a hydrocarbon fuel, usually gasoline) H. Three general stages involved in carburetion 1. Metering 2. Atomization 3. Vaporization I. Vacuum produced by an engine draws fuel through the throat (venturi) of carburetor, atomizing it J. As it passes through the intake manifold, engine heat vaporizes it	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Parts of textbook/manual E. Following directions F. Outlining and note taking G. Test taking skills H. Writing skills I. Spelling J. Oral communication K. Study skills	A. Whole numbers B. Decimals C. Ratio and proportion D. Torque	A. Chemical reactions B. Heat C. Fuels D. Atomization E. Vaporization	A. The student will be able to demonstrate a basic understanding of fuel injection operation by passing a written test B. The student will be able to demonstrate knowledge of safe working practices by passing a written test C. The student will be able to demonstrate an ability to remove and replace a fuel pump by achieving a moderate level of skill on a performance test D. The student will be able to demonstrate a knowledge of basic carburetor operation by passing a written test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
IX. Identify and describe the six basic carburetor circuits X. Rebuild and adjust a carburetor XI. Diagnose driveability problems in a carburetor equipped fuel system	A. There are six basic carburetor circuits, each with a different function 1. Float 2. Idle 3. Accelerator pump 4. Main metering 5. Enrichment 6. Choke B. Carburetor overhaul consists of basic steps 1. Carburetor identification 2. Disconnecting attachments to the carburetor 3. Carburetor removal 4. Carburetor disassembly 5. Cleaning and inspection 6. Replacement of parts and gaskets 7. Bench adjustments 8. Re-assembly 9. Replacement on vehicle 10. Re-attaching parts 11. Final adjustments C. Driveability describes the proper operation of a vehicle D. Driveability problems 1. Dieseling 2. Detonation 3. Stalling 4. Rough idle 5. Hesitation 6. Surging 7. Sluggishness 8. Poor gas mileage	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Parts of textbook/manual E. Following directions F. Outlining and note taking G. Test taking skills H. Writing skills I. Problem solving J. Spelling K. Oral communication L. Study skills	A. Decimals B. Measurement C. Ratio and proportion D. Whole numbers E. Common fractions	Fuels - stiochiometric proportion (the ideal air to fuel ratio is 14.7 parts air to 1 part fuel)	A. The student will be able to demonstrate a knowledge of the six basic carburetor circuits by passing a written test B. The student will be able to demonstrate an ability to rebuild a carburetor by achieving a moderate level of skill on a performance test C. The student will be able to demonstrate a knowledge of common fuel system problems by passing a written test and by achieving a moderate degree of accuracy in actual diagnosis of fuel system problems

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
XII. Explain the advantages of fuel injection over carburetion XIII. Describe the function of an electronic fuel injection system XIV. Perform fuel injection system preventive maintenance	A. In a gasoline engine, fuel injection performs the same functions as a carburetor B. Fuel injection systems offer several advantages over carburetion 1. Increased volumetric efficiency 2. More efficient combustion 3. Better fuel economy 4. More power 5. Less harmful exhaust gases C. Fuel distribution to each of the cylinders in precise amounts to insure the proper mixture D. A fuel injection system must provide the correct air-fuel ratio for all engine load, speed and temperature conditions E. The basic system 1. Fuel tank and connecting lines 2. Fuel pump(s) 3. Fuel pressure regulator 4. Fuel filters 5. Electronic control unit 6. Input information sensors 7. Fuel injectors F. Preventive maintenance for fuel injection systems includes checking and repairing or replacement of 1. Fuel and air leaks 2. Loose or damaged vacuum lines 3. Loose or corroded electrical connections 4. Loose or improperly supported fuel rails, lines and injectors 5. Dirty fuel and air filters 6. Incorrect idle speed or	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Parts of textbook/manual E. Following directions F. Outlining and note taking G. Test taking skills H. Writing skills I. Problem solving J. Spelling K. Oral communication L. Study skills	A. Measurement B. Ratio and proportion	A. Fuels - stiochiometric proportion (the ideal air to fuel ratio is 14.7 parts air to 1 part fuel) B. Volume C. Combustion	A. The student will be able to demonstrate a knowledge of the advantages of fuel injection over carburetion by passing a written test B. The student will be able to demonstrate an ability to describe the basic operation of an electronic fuel injection system by passing a written test C. The student will be able to demonstrate a knowledge of preventive maintenance procedures for fuel injection systems by passing a written test and by achieving a moderate level of skill on a performance test

UNIT: MEASUREMENT

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Demonstrate a knowledge of metric and standard systems of measurement and proper use of measuring devices	A. Types of measuring tools B. Degree of accuracy or precision C. Machinist's scale D. Calipers E. Dividers F. Feeler gauge G. Telescoping gauge H. Micrometers 1. Inside 2. Outside 3. Depth I. Dial indicator	A. Vocabulary B. Following directions C. Problem solving D. Spelling E. Oral communication F. Note taking skills G. Test taking skills	A. Whole numbers B. Common fractions C. Decimals D. Weights and measurement E. Ratio and proportion F. Metric conversion		The student will be able to demonstrate an ability to properly and accurately use various types of measuring devices as determined by passing a written test and performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Define and explain terms A. Energy B. Force C. Work D. Power	A. Basic terms that describe physical processes help in understanding how an automobile engine works	A. Functional reading skills	A. Measurement	A. Heat 1. Heat energy is produced by the rapid burning of fuel which exerts force on the piston, thus producing mechanical energy 2. Work is the applying of force to an object, causing it to move 3. Power is the rate, or how fast the work is done 4. The engine produces torque, or twisting force to turn the drive wheels	A. The student will be able to demonstrate an ability to describe the basic physics involved in an internal combustion engine operation by passing a written test
II. Identify and describe the functions of the internal parts of an automotive engine	B. Energy, force, work and power are concepts to be understood before beginning to understand the operation of an internal combustion engine	B. Vocabulary	B. Physics	B. Fuels	B. The student will be able to demonstrate an ability to identify and describe the parts of an internal combustion engine by passing a written test
III. Describe the four stroke cycle	C. Major parts of an automotive internal combustion engine 1. Cylinder block 2. Pistons and rings 3. Crankshaft 4. Connecting rods 5. Bearings 6. Cylinder head 7. Valves 8. Camshaft and valve 9. Train 10. Flywheel 11. Fuel system 12. Exhaust system	C. Fact/Opinion distinction	C. Torque	C. Friction	C. The student will be able to demonstrate a knowledge of the four stroke cycle by passing a written test
IV. Determine the compression ratio of an engine	D. The basic engine must draw in an air/fuel mixture, compress it, burn it and get rid of the gases - four stroke cycle	D. Parts of textbook/manual	D. Whole numbers	D. Metalurgy 1. Different types of metal used in an engine a. cast iron b. aluminum c. steel (various degrees of hardness) d. other alloys 2. All react to the heat of combustion in different manners	D. The student will be able to demonstrate an ability to determine compression ratio by passing a written test
V. Determine the cubic inch displacement of an automotive engine	E. The compression ratio is a comparison between the volume above the piston at BDC and the volume above the piston at TDC (clearance volume)	E. Following directions	D. Common fractions	E. Chemical reactions	E. The student will be able to demonstrate an ability to determine cubic inch displacement of an engine by passing a written test
	F. The volume of the combustion chamber in the cylinder head must be considered when determining compression ratio	F. Outlining and note taking	E. Decimals	F. Volume	
	G. Simplified formula for engine displacement 0.785 X bore diameter 2 X length of stroke X number of cylinders	G. Test taking skills	F. Ratio and proportion	G. Compression	
		H. Writing skills	G. Formulas		
		I. Problem solving	G. Metric conversion		
		J. Spelling			
		K. Oral communication			
		L. Study skills			

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
VI. Explain the formula for determining engine horsepower and torque and explain the relationship of horsepower and torque VII. Describe how friction may affect engine performance	A. Formula for determining work Work = Force X Distance B. If torque output of an engine at a given RPM is known, horsepower can be determined by a formula Horsepower = Torque X RPM divided by 5,252 C. Different types of friction may be present between parts in an engine 1. Dry friction 2. Greasy friction 3. Viscous friction	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Common fractions C. Decimals D. Measurement E. Formulas F. Torque G. Graphs	Friction 1. Dry friction occurs when objects move in direct contact with each other, causing heat and wear 2. Greasy friction exists when a thin film of oil or grease is present between the surfaces 3. Viscous friction is the resistance to motion of liquids - the viscosity rating of motor oil is a measurement of its resistance to flow	A. The student will be able to demonstrate an ability to use formulas to determine horsepower and torque by passing a written test B. The student will be able to demonstrate an ability to describe the effects of different types of friction by passing a written test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Explain and describe basic cylinder head design configuration II. Describe valve design and function III. Describe the components of a valve assembly	A. The cylinder head forms the combustion chamber B. Combustion chamber design can vary with the engine design C. Two types of cylinder heads commonly used in gas engines 1. Wedge combustion chamber 2. Hemispherical combustion chamber D. Four types are commonly used in diesel engines 1. Open chamber 2. Man-M 3. Prechamber 4. Swirl chamber E. Valves in an engine must be able to function reliably under harsh conditions for many miles F. During harsh conditions, the valves may be cycled several hundred million times G. Diesel engines operate at much higher pressures and temperatures with the hottest part being on the top center of the valve head H. A valve consists of the following areas 1. Valve stem 2. Valve tip 3. Valve spring retainer lock grooves 4. Fillet 5. Face 6. Margin 7. Head	A. Functional reading skills B. Vocabulary C. Fact/Opinion distinction D. Parts of textbook/manual E. Following directions F. Outlining and note taking G. Test taking skills H. Writing skills I. Spelling J. Oral communication K. Study skills	A. Measurement B. Formulas C. Geometry D. Metric conversion E. Decimals	A. Fuels 1. When gas ignites, it does not explode, it burns rapidly in expanding circles 2. Combustion chamber design determines energy distribution on the top of the piston B. Heat 1. All engine parts are affected by heat 2. Moving parts of an engine grow larger when heated C. Friction 1. All moving parts in an engine eventually wear no matter how well lubricated 2. Clearances between moving parts in an engine are critical and wear must be accurately determined to effectively service or repair an engine	A. The student will be able to accurately identify the different types of combustion chambers B. The student will be able to identify and explain the function of combustion chambers in gas and diesel engines by passing a written test C. The student will be able to identify the design and function of gas and diesel engine valves by passing a written test D. The student will be able to accurately describe the seven parts of a valve

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
IV. Describe the components of the valve spring assembly V. Explain and describe valve guide design and function VI. Describe the design and function of valve seats	A. A valve spring assembly can include the following parts 1. Spring seat 2. Valve stem seal 3. Valve spring 4. Spring damper 5. Spring retainer 6. Valve locks 7. Valve rotator B. The valve guide keeps the valve concentric C. Valve guides must help cool the valve stem by heat transfer D. Valves move up and down and can rotate in the valve guide E. Valve guides are either insert or integral type F. Valve seats seal the combustion chamber by contacting the valve face G. Valve seat distortion is the major cause of valve failure H. Seat distortion can be temporary due to pressure and thermal stress I. Seat distortion can be permanent due to mechanical stress J. Seats can be integral or insert type	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Decimals B. Measurement C. Metric conversion D. Geometry	A. Heat 1. All engine parts are affected by heat 2. Moving parts of an engine grow larger when heated B. Stress There is great strain and force exerted on valve springs that tends to deform its pressure in pounds per inch C. Friction 1. All moving parts in an engine eventually wear no matter how well lubricated 2. Clearances between moving parts in an engine are critical and wear must be accurately determined to effectively service or repair an engine D. Metallurgy 1. There are many types of materials used to make moving engine parts 2. Metallurgy is the science of separating metals from their ores and preparing them for use by smelting and refining	A. The student will be able to demonstrate a knowledge of basic valve spring assembly by passing a written test B. The student will be able to demonstrate an ability to describe valve guides by passing a written test C. The student will be able to identify various valve seat problems D. The student will be able to accurately identify the two types of valve seats E. The student will be able to identify the material make-up of valve seats

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
VII. Explain and describe basic rocker arm function and design VIII. Explain the design and function of valve stem oil seals IX. Describe the difference between overhead camshaft and push rod valve train designs	A. Rocker arms reverse the upward movement of the lifter and push rod to produce a downward movement on the valve tip B. Rocker arms use the principle of levers to change the amount of movement C. Rocker arms can be independent 1. On shafts by two's 2. All rockers on one shaft D. Rocker arms can be aluminum, stamped steel or forged E. Leakage past valve guides will cause oil consumption in an overhead valve engine F. There is high vacuum in an intake port - vacuum pulls oil from the rocker arm area of the engine G. Valve seals or deflectors were developed to control oil H. Seals are positive stop, O rings or umbrella type I. Seals are made from rubber, teflon or plastic J. Overhead camshafts (OHC) can use a single overhead camshaft (SOHC) with the intake and exhaust lobes on the same shaft or dual overhead cam (DOHC) with intake and exhaust lobes on two shafts K. Push rod valve trains use a combination of camshaft, lifters, push rods and rockers to control valve opening and closing	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Ratios B. Measurement C. Formulas D. Geometry E. Metric conversion F. Decimals	A. Heat 1. All engine parts are affected by heat 2. Moving parts of an engine grow larger when heated B. Friction 1. All moving parts in an engine eventually wear no matter how well lubricated 2. Clearances between moving parts in an engine are critical and wear must be accurately determined to effectively service or repair an engine	A. The student will be able to demonstrate a knowledge of rocker arm design and function by passing a written test B. The student will be able to demonstrate a knowledge of guide leakage, intake vacuum and valve seal design by passing a unit quiz C. The student will be able to demonstate an ability to describe the difference between overhead camshaft and push rod valve train designs by passing a written test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the design and function of push rods II. Describe the design and function of valve lifters	A. Push rods are designed to be as light as possible and still have strength B. Push rods are either solid or hollow C. Push rods direct oil flow D. Push rods use a convex ball on the ends for seating E. All engines use one of three types of valve lifters 1. Solid lifters 2. Hydraulic lifters 3. Roller lifters F. Valve trains using solid lifters require running with clearance to insure the valve will close G. Hydraulic lifters are a small precision made hydraulic cylinder used with no clearance because the hydraulic unit takes up all the lash H. Roller lifters were designed to handle the high stress on the lifter and the cam lobe of diesel engines I. Zero lash adjusters are a form of hydraulic lifter used as a fulcrum rather than to lift the valve	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Outlining and note taking E. Test taking skills F. Writing skills G. Spelling H. Oral communication I. Study skills	A. Measurement B. Decimals C. Metric conversion	A. Heat All moving parts of the valve train expand when the engine reaches operating temperatures B. Hydraulics 1. Hydraulics is the creation of force or motion by fluid under pressure 2. A hydraulic lifter uses oil under pressure to transfer force to the valve train	A. The student will be able to demonstrate a knowledge of push rod function and design make-up by passing a unit quiz B. The student will be able to demonstrate an ability to describe solid, hydraulic and roller lifter operation by passing a written test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
III. Describe the design, function and surfaces which make up a camshaft IV. Describe the design and operation of camshaft drives	A. The cam lobe incorporates five different surfaces 1. Base circle 2. Clearance ramp 3. Opening ramp 4. Nose 5. Closing ramp B. The camshaft changes its rotary motion into the linear up and down motion of the valve C. Cam lobes affect engine operating speed, temperature compression ratio and emission control limits D. Cam operation greatly changes in a diesel engine due to combustion chamber design E. The design of a camshaft alone can allow an engine to operate in a clockwise or counter-clockwise direction F. There are three basic types of camshaft drives 1. Belts 2. Chains 3. Gears G. Overhead cam valve trains (OHC) incorporate extra shafts and pulleys to aid in a smooth operation of the camshaft H. The addition of gears or pulleys to a cam drive will change its direction I. Camshafts and drives can be changed to have an engine operate in either direction	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Outlining and note taking E. Test taking skills F. Writing skills G. Spelling H. Oral communication I. Study skills	A. Measurement B. Duration angle C. Degrees D. Event length E. Ratios	A. Heat All moving parts of the valve train expand when the engine reaches operating temperatures B. Friction 1. Clearances between the moving parts of a valve train are critical 2. Any amount of wear caused by to much friction will change the total operation of the engine	A. The student will be able to demonstrate a knowledge of camshaft design and operation, and identify its basic parts and their function to engine changes by passing a written test B. The student will be able to demonstrate an understanding of camshaft drives design and function by passing a written test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe engine block design and configurations and design considerations	A. An engine block must consider the combustion area to control the internal explosion B. Required power must be provided within the established weight, space and cost limitations C. Gas and diesel blocks have multi cylinders; the way the cylinders and combustion chambers are arranged is the engine configuration D. There are three standard types of blocks 1. In line 2. V-type 3. Opposed	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Decimals C. Metric conversion D. Whole numbers E. Geometry	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways	A. The student will be able to describe engine block design, configuration and considerations by passing a unit quiz B. The student will be able to identify the different block styles and metals used in gas and diesel blocks

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
II. Describe the internal systems which make up the engine block	A. Main bearing caps give the lower block strength B. The block deck must be smooth and true to seal the upper engine C. Cooling passages must be provided around cylinders to prevent distortion D. Lubricating passages are drilled throughout the block to carry oil (under pressure) from the pan through the entire engine	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Decimals B. Fractions C. Metric conversion	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways	The student will be able to describe the systems which make up the internal engine block by passing a unit quiz

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe crankshaft design and construction	A. The crankshaft must change the downward power pulses from the connecting rods into a rotating motion B. The areas where bearings support and protect the spinning crankshaft are called journals C. Rod journals are located on the throws, or the offset areas of the crankshaft where the connecting rods are located, and main journals are the areas where the crankshaft is attached to the block D. Crankshafts can be cast, forged, or machined from a solid bar, or billet E. During manufacture, counterweights are formed to balance the offset throws	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	Measurement	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways C. Friction - all internal engine parts ride on a film of oil; improper oiling causes an increase of friction leading to engine failure	The student will be able to demonstrate an ability to describe the design and construction of a crankshaft by passing a unit quiz

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the function of bearings within an engine	A. One of the most important factors in engine life is the durability of engine bearings B. If bearings fail, the entire engine will be ruined C. Friction is the resistance between two materials in contact with each other D. To reduce friction, two types of bearings can be used 1. Anti-friction ball and roller bearings 2. Friction, or insert bearings E. Crankshaft bearings are friction bearings also known as precision insert bearings F. Camshafts and counter shafts also use friction insert bearings	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Decimals B. Measurement C. Metric conversion	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways C. Friction - all internal engine parts ride on a film of oil; improper oiling causes an increase of friction leading to engine failure	The student will be able to demonstrate an ability to describe the function of engine crankshaft bearings by passing a unit quiz

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe connecting rod design, function and structure	A. The connecting rods form a connection between the piston and crankshaft to convert the energy of combustion into useful rotating motion B. A connecting rod must be strong but as lightweight as possible C. To allow the engine to run smooth, rods must be balanced D. In structure, rods must be free of twist and bends, therefore, the axis of the small end bore must be parallel to the axis of the large end bore E. Rods must have a split cap to enable them to be removed and installed F. Markings and identification allow for how a rod must be placed in a cylinder	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Decimals C. Metric conversion	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways C. Friction - all internal engine parts ride on a film of oil; improper oiling causes an increase of friction leading to engine failure	The student will be able to describe the design, function and structure of a connecting rod by passing a unit quiz

UNIT: ENGINE SYSTEMS - CONTINUED

TOPIC: PISTON, PINS AND RINGS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Identify the major parts of a piston and describe its function within the engine	A. The piston must be able to withstand the heat of combustion and transfer force to the connecting rod B. To meet these requirements, the piston must be both light and strong C. The piston is comprised of the following major parts 1. Land 2. Head 3. Skirt 4. Compression ring grooves 5. Oil ring groove 6. Wrist pin hole	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Whole numbers C. Decimals D. Metric conversion	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways C. Friction - all internal engine parts ride on a film of oil; improper oiling causes an increase of friction leading to engine failure	The student will be able to demonstrate a knowledge of piston parts and their function by passing a unit quiz

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
II. Describe the construction, retaining methods and function of the wrist pin within a piston	A. Piston pins are used to hold the piston to the connecting rod B. Pins are made from high quality steel in the shape of a tube to make it both light and strong C. Piston pins are located offset in a piston D. There are two types of piston pin fit 1. Press fit 2. Free floating	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Decimals C. Metric conversion	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways C. Friction - all internal engine parts ride on a film of oil; improper oiling causes an increase of friction leading to engine failure	The student will be able to describe the construction, function and retaining methods of a wrist pin by passing a unit quiz
III. Describe the design, function and operating demands of piston rings within an engine	A. Piston rings, like pistons, are carefully engineered components B. The demands placed on piston rings are exacting; they must keep combustion gases out of the crankcase and oil out of the combustion chamber C. Compression rings have several types of face design and coatings to prevent failure in a great many applications D. Rotary engines use apex seals in place of piston rings	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Decimals C. Whole numbers D. Metric conversion	A. Heat 1. Heat of compressed gases 2. Effects of high temperatures due to abnormal operation 3. Expansion and contraction B. Metallurgy - different metals react to each other in different ways C. Friction - all internal engine parts ride on a film of oil; improper oiling causes an increase of friction leading to engine failure	A. The student will be able to identify the different designs and coatings used in making piston rings B. The student will be able to describe the function of piston rings in an engine by passing a unit quiz

UNIT: ENGINE SYSTEMS - CONTINUED

TOPIC: GASKETS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the function performed by the gaskets within an engine	A. A gasket forms a seal by being compressed between two parts B. Gaskets can be made of soft materials such as cork, rubber, paper asbestos, or a combination of these materials C. Gaskets can also be formed of soft metals such as copper, brass, aluminum, etc.	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills			The student will be able to demonstrate an ability to describe the function of gaskets within an engine by passing a unit quiz

UNIT: PARTS AND ORGANIZATION

TOPIC: SHIPPING AND RECEIVING

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Stocking, shipping and receiving	A. Terms and definitions B. Organization of parts C. Forms of transportation D. Methods of payment E. Procedure for receiving shipment	A. Functional reading skills B. Vocabulary C. Parts of catalogue D. Following directions E. Outlining and note taking F. Problem solving G. Spelling H. Oral communication I. Test taking skills	A. Whole numbers B. Percentages C. Decimals D. Weights and measures		A. The student will be able to match terms related to stocking, shipping and receiving with their correct definitions B. The student will be able to list forms of shipping and receiving parts C. The student will be able to define the method of payment used in shipping and receiving parts
II. Inventory control	A. Terms and definitions B. Inventory control systems C. Coding systems for popularity of parts	A. Functional reading skills B. Vocabulary C. Parts of catalogue D. Following directions E. Outlining and note taking F. Problem solving G. Spelling H. Oral communication I. Test taking skills	A. Whole numbers B. Percentages		A. The student will be able to match terms related to inventory control with their correct definitions B. The student will be able to complete a list of needs fulfilled by good inventory control C. The student will be able to complete a list of the coding system for popularity

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the basic function and operation of injection pumps and governors	A. The injection pump must develop fuel pressures greater than compression pressures developed in the cylinder B. Internal pump timing considers the beginning of injection in terms of rotation of the pump main shaft C. Engine timing considers the beginning of injection in terms of the piston location D. The governor controls the speed of the engine E. The injection nozzles deliver high pressure fuel into a pre-combustion chamber	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Decimals C. Metric conversion D. Measurement	A. Pressures B. Heat and temperatures	A. The student will be able to demonstrate a knowledge of injector pump operation by passing a unit quiz B. The student will be able to demonstrate the injection-governor function and adjustment by passing a performance test

UNIT: MANIFOLDS

TOPIC: INTAKE MANIFOLDS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the design and operation of an intake manifold	A. The intake manifold is the engine induction system of air and fuel or air alone B. Aluminum and cast iron are the most common types of materials C. Intake manifolds require an exhaust or water heating system D. Modern intake manifolds employ electronic controls to regulate air or fuel distribution	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Decimals C. Metric conversion D. Ratios	A. Vaporization B. Atmospheric pressure C. Heat	A. The student will be able to describe the function of the intake manifold on an engine B. The student will be able to distinguish the operation of pressure needed in the intake for operation by passing a unit quiz

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the construction and function of exhaust manifolds	A. Most exhaust manifolds are bolted to the cylinder head without a gasket B. The high temperature of an exhaust manifold can lead to problems with cracking and warping C. An exhaust manifold can crack from thermal fatigue or thermal cycling D. Some exhaust manifolds on in-line engines are directly attached to the intake manifold	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Decimals C. Metric conversion D. Ratios	A. Heat transfer B. Internal pressure	The student will be able to demonstrate an ability to describe the function of exhaust manifolds by passing a unit quiz

UNIT: TURBOCHARGING AND SUPERCHARGING

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the basic function and operation of a turbocharger versus a supercharger	A. To increase the power output of an engine, the volumetric efficiency must be increased B. A supercharger is an air compressor driven by a mechanical coupling to the engine C. Turbocharging differs from supercharging because there is no mechanical energy taken from the engine D. There are two types of charging 1. Draw through 2. Blow through E. Modern engines use electronic controls to regulate charging	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Metric conversion C. Ratios D. Measurement E. Geometry F. Formulas	A. Friction B. Heat transfer C. Fuels	A. The student will be able to describe the functions of turbocharging versus supercharging by passing a unit quiz B. The student will be able to demonstrate the operation of charging by passing a performance test

UNIT: ENGINE OVERHAUL

TOPIC: DISASSEMBLY

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the order of events necessary in disassembly and overhauling a complete engine	A. There are ten basic steps to be followed in engine disassembly B. Component and accessory identification is universal C. Identification of un-useable parts should be accomplished during disassembly D. Causes of engine failure are noted during disassembly	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills			The student will be able to demosntrate the procedure for engine disassembly by passing a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Describe the procedure and equipment used in degreasing and cleaning engine components prior to machining	A. Cleaning equipment and its waste must meet strict E.P.A. disposal regulations B. There are three basic types of cleaning equipment C. Blast cleaning of all components is necessary for proper engine overhaul	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Ratio B. Proportion	A. Heat 1. Heat is the main element of all cleaning equipment 2. Heat must be properly maintained to insure against undue damage to engine components B. Friction - friction by air pressure used in cleaning can damage soft internal engine parts	The student will be able to demonstrate the proper procedures necessary in cleaning all engine parts prior to overhaul by passing a safety and performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Use the proper measuring device to measure cylinder bore diameter and taper	Different measuring devices can be used to measure cylinder bore diameter and taper 1. Inside micrometer 2. Telescoping gauge 3. Cylinder dial bore gauge	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Decimals C. Metric conversion D. Measurement	Friction 1. All moving parts in an engine eventually wear, no matter how well lubricated 2. Clearances between moving parts in an engine are critical and wear must be accurately determined to effectively service or overhaul an engine	The student will be able to demonstrate an ability to measure cylinder bore diameter and taper by achieving a moderate level of skill on a performance test
II. Measure crankshaft journals with an outside micrometer	Crankshaft journals must be measured to determine if wear has exceeded limitations	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Decimals C. Measurement D. Metric conversion	Friction 1. All moving parts in an engine eventually wear, no matter how well lubricated 2. Clearances between moving parts in an engine are critical and wear must be accurately determined to effectively service or overhaul an engine	The student will be able to demosntrate an ability to measure crankshaft journals with a micrometer by achieving a moderate level of skill on a performance test

UNIT: ENGINE OVERHAUL - CONTINUED

TOPIC: ENGINE BLOCK (GASOLINE)

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Re-bore gasoline engine block to achieve proper oversize II. Re-bore of a cracked or broken cylinder in a gasoline engine to be repaired with a press in sleeve (dry sleeve)	A. Cylinders in a block wear out of shape and must be re-bored to an exact oversize to accept new pistons B. Broken cylinders can be repaired by the installation of a stepped press fit sleeve	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Whole numbers B. Decimals C. Measurement D. Metric conversion E. Fractions	A. Heat - internally, an engine produces an extreme amount of heat; due to combustion, this heat must be considered when re-boring an engine due to piston expansion B. Friction - cylinder bores must be kept to an exact size and clearance due to the extreme friction caused by the piston rings	The student will be able to demonstrate an ability to re-bore and sleeve a gasoline engine block by achieving a moderate level of skill on a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Remove and replace cylinder liners in a diesel block	A. Diesel engines have both wet and dry cylinder liner replacement B. When cylinders are worn beyond an acceptable limit in a diesel, they are replaced as opposed to being re-bored C. Wet liners, which make up the diesel block, are sealed from water by flat seals or O rings	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Whole numbers B. Decimals C. Measurement D. Metric conversion E. Fractions	A. Heat - internally, an engine produces an extreme amount of heat; due to combustion, this heat must be considered when re-boring an engine due to piston expansion B. Friction - cylinder bores must be kept to an exact size and clearance due to the extreme friction caused by the piston rings	The student will be able to demonstrate an ability to replace cylinder liners in a diesel block by achieving a moderate level of skill on a performance test

TOPIC: CYLINDER HONING

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Hone cylinders to enable piston rings to properly seat against cylinder wall	A. All cylinders, whether re-bored or just re-fitted with new rings, must have a proper wall finish for different types of rings to seal properly B. There are two types of cylinders 1. Aluminum silicone 2. Cast iron C. Each cylinder must have a different wall finish D. Piston rings are made of various materials; with each different material, a different finish must be achieved E. There are three ways of honing a cylinder 1. Portable hand method 2. Friction feed 3. Automatic resizing	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Whole numbers B. Decimals C. Measurement D. Metric conversion E. Fractions	A. Heat - internally, an engine produces an extreme amount of heat; due to combustion, this heat must be considered when re-boring an engine due to piston expansion B. Friction - cylinder bores must be kept to an exact size and clearance due to the extreme friction caused by the piston rings	A. The student will be able to demonstrate an ability in deciding if a cylinder will accept honing and replacing standard rings B. The student will be able to demonstrate an ability to finish hone a re-bored cylinder to proper wall finish and clearance by achieving a moderate level of skill on a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. The head surface of a block (gas or diesel) must be parallel to the crankshaft centerline	A. To enable compression height to remain the same in all cylinders of a diesel when linders have been replaced, it is often necessary to grind the block surface B. The blocks of a gasoline engine are cast, therefore, the centerline of cylinders to crankshaft may very often vary by a large margin; by block decking this situation can be corrected C. To insure that both sides of a V-type block are equal, decking is a necessary operation	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Measurement B. Ratios C. Whole numbers		A. The student will be able to demonstrate an ability of problem solving of an irregular cylinder with a moderate level of skill on a performance test B. The student will be able to demonstrate an ability to re-surface the deck of an engine block with a moderate level of skill on a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Perform a crack inspection of a crankshaft (magnaflux) II. Perform an inspection of a crankshaft for straightness	A. A crankshaft is either cast or forged; in each case, the power exerted on a crank can cause it to bend or crack B. A forged crank can be straightened, but a cracked crankshaft must be replaced C. Crankshafts are tested for cracks by dying and magnetizing; this is a necessary operation before any machining is attempted	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving		Electricity 1. Electric is used in the magnetize and demagnetize test of a crankshaft 2. The correct ratio of electric to steel or iron will mean the difference of proper and improper testing	A. The student will be able to demonstrate a knowledge of useable or un-useable crankshafts B. The student will be able to demonstrate an ability to set up and test a crankshaft for cracks by achieving a moderate level of skill on a performance test
III. Perform the operation of polishing a crankshaft to accept bearings of .001 or .002 (one or two thousands)	A. It is not necessary to regrind all crankshafts B. A good useable crank can be re-polished to an acceptable finish and undersized bearings installed C. Polishing is also a necessary final operation for crankshafts which have been re-ground D. It is always preferred to polish as opposed to regrind (if possible) because much less material is removed from the crank surface	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Measurement B. Decimals C. Metric conversion		The student will be able to demonstrate a knowledge of the proper procedure for crankshaft polishing by passing a performance test with a moderate level of skill

UNIT: ENGINE OVERHAUL - CONTINUED

TOPIC: BLOCK MAIN SADDLES

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Perform an accurate measurement of block main saddles	A. Gas or diesel blocks must have a true line for the crankshaft to ride in B. The main bearing bore of a diesel is most critical due to the excessive loads placed on them C. All blocks can be returned to a true main bearing alignment by a process called align boring	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Measurement B. Decimals C. Metric conversion		The student will be able to demonstrate an ability to check main bearing saddles for alignment wtih a moderate level of skill during a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Re-size the crankshaft end of connecting rods II. Re-size the wrist pin end of a connecting rod to accept oversized pins III. Replace and re-size wrist pin bushings in the rod to accept standard pin replacements	A. Connecting rods on any engine to be rebuilt must be reconditioned to achieve proper shape and oil clearance B. Oversized wrist pins can be used to repair a worn condition without replacing the entire piston C. All diesel and severe duty gas engines use bushings for the wrist pin; because this is a high stress area, bushings must always be replaced during a rebuild	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Measurement B. Decimals C. Metric conversion D. Whole numbers	A. Heat - internally, an engine produces an extreme amount of heat; due to combustion, this heat must be considered when re-boring an engine due to piston expansion B. Friction - cylinder bores must be kept to an exact size and clearance due to the extreme friction caused by the piston rings	A. The student will be able to demonstrate a knowledge of measurement of connecting rods to determine the type of repair needed B. The student will be able to demonstrate an ability to recondition connecting rods with a moderate level of skill during a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Disassemble, clean and inspect a cylinder head noting repairs that are necessary and procedures to follow	A. Valves, valve seats, guides and springs are all subject to damage caused by wear, excessive heat, poor lubrication or improper clearances B. The gasket surface of a cylinder head can distort due to overheating; this surface must be re-machined to insure a proper seal	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Whole numbers B. Geometry C. Measurement D. Decimals E. Metric conversion	A. Heat - internally, an engine produces an extreme amount of heat; due to combustion, this heat must be considered when re-boring an engine due to piston expansion B. Friction - cylinder bores must be kept to an exact size and clearance due to the extreme friction caused by the piston rings C. Metallurgy 1. Many different types of metals are used in an engine 2. These may include cast iron, aluminum, steel of various degrees of hardness and other alloys 3. All react to the heat of combustion in different manners	The student will be able to demonstrate an ability to recognize the problem areas of a cylinder head, noting their cause and the procedure of repair by passing a performance test with a moderate level of skill
II. Inspect a cylinder head for damage caused by overheating	A. Modern engines run at very high temperatures; excessive heat can cause heads to warp or crack B. Some cracks in heads can be repaired; their location must be determined before any other work is performed C. Pressure testing is the most modern and accurate method used to determine cracks in a cylinder head D. Diesel heads often crack due to high compression and lean mixture; injector tube must be removed to locate many faults	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Measurement C. Decimals	Heat - cylinder heads are greatly affected by water temperature and the heat of combustion must be considered when a head is to be inspected	A. The student will be able to demonstrate an ability to inspect a cylinder head for warpage B. The student will be able to set up and perform a pressure test on cylinder heads with a moderate level of skill

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
III. Valve guides A. Knurle valve guides in a cylinder head B. Replace valve guides in a cylinder head (removable) C. Replace valve guides in a cylinder head (integral)	A. Some valve guides receive only a minimal amount of wear; knurling is an acceptable repair B. Most foreign and diesel heads have removable valve guides; when worn they must be replaced C. All American built engines have the valve guides cast as part of the cylinder head; when worn, they must be bored a sleeved to achieve a proper repair	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Whole numbers B. Decimals C. Geometry D. Measurement E. Metric conversion	A. Heat 1. Valve guide diameter is affected by heat 2. If the proper clearances are not maintained, valve damage may result B. Friction 1. All moving parts in an engine eventually wear, no matter how well lubricated 2. Clearances between moving parts in an engine are critical and wear must be accurately determined to effectively service or repair an engine	A. The student will be able to demonstrate an ability to resize (knurle) valve guides with a moderate level of skill B. The student will be able to demonstrate an ability to replace valve guides in a diesel head C. The student will be able to demonstrate an ability to set up, bore and sleeve valve guides with a moderate level of skill during a performance test
IV. Valve seats A. Remove and replace valve seats in a cylinder head (removable) B. Replace valve seats in a cylinder head (integral)	A. Diesel and foreign cylinder heads have seats which may be pressed in and out when they are damaged B. All American built engines have valve seats cast as part of the cylinder head; when seats are badly worn, they must be bored and an insert installed	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction L. Problem solving	A. Whole numbers B. Decimals C. Fractions D. Measurement E. Metric conversion F. Geometry	Heat 1. Valve seat diameter is greatly affected by combustion heat 2. If the proper interference fit is not maintained, the seat may fall out causing extensive engine damage	A. The student will be able to demonstrate an ability to remove and replace removable valve seats B. The student will be able to demonstrate proper set up and procedure to bore and install a valve seat insert in an integral head to a minus -.0/0 F.T. (ten thousands)

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
V. Reface valves and valve stems of different materials	A. When reconditioning a cylinder head, all valves and their stems must be machined to insure proper seating B. Valves are made of hard or soft metals in different applications; this must be established before machining C. Proper valve stem length must be maintained to insure proper rocker arm geometry	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Angles C. Decimals D. Metric conversion	Metallurgy 1. The valves in an engine are made of mild steel, stainless steel or steelite 2. Grinding of different materials must be done at different speeds or an improper finish will result	The student will be able to demonstrate an ability to set up and reface valves and valve stems showing the proper R.P.M. range for grinding different materials with a moderate level of skill
VI. Reface the valve seats within the cylinder head using various methods of grinding	A. The face and angles of a valve seat must match the valve properly or it will cause valves to prematurely burn or loss of compression B. Valve seats in a modern engine are hardened to accept un-leaded fuel, therefore, various types of seating equipment must be used C. All diesel engines use steelite valve seats; these seats are best reconditioned using solvent type cutters	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Decimals C. Metric conversion		The student will be able to demonstrate an ability to recondition valve seats using three methods for refacing with a moderate level of skill during a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
VII. Set up and surface grind the gasket surface of a cylinder head	A. Overheating causes cylinder heads to warp; if the head is not reground, water will enter the cylinders causing extreme damage to the internal parts of the lower engine B. As a common practice, the gasket surface should always be refaced to insure a good seal C. Care must be taken when a diesel or over head cam (O.H.C.) cylinder head is to be resurfaced as there are minimal amounts of material which can be removed from these types of heads	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Decimals C. Measurement D. Geometry E. Metric conversion	Heat - cylinder heads are greatly affected by water temperature and the heat of combustion must be considered when a head is to be inspected	The student will be able to demonstrate an ability to properly set up and surface grind the head gasket surface of a cylinder head with a moderate level of skill during a performance test
VIII. Test valve springs for squareness, pressure, coil bind and height	A. Valve spring pressure and height is important to insure that the valve will open and close properly to prevent the valve from leaking B. Squareness and coil bind must be checked to prevent any damage to the camshaft C. All springs must be within 10% of the original pressure; shims can be added to increase pressures but only to a minimum amount	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Whole numbers B. Fractions C. Decimals D. Geometry E. Metric conversion	A. Heat - cylinder heads are greatly affected by water temperature and the heat of combustion must be considered when a head is to be inspected B. Pressure 1. Valve springs are a tightly wound, hardened coil of steel 2. Springs must overcome the forces of combustion and the stress put on them by the loads of a camshaft	The student will be able to demonstrate an ability to test valve springs for squareness, pressure, coil bind and height noting variations with a moderate level of skill

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
IX. Assembling cylinder heads A. Re-assemble a reconditioned cylinder head, install new valve seals (standard gas engine) B. Assemble an O.H.C. cylinder head and adjust valves	A. Care must be taken when assembling a cylinder head to avoid damaging any reconditioned parts B. All parts are laid out and lubricated prior to assembly to insure a proper assembly is achieved C. O.H.C. valve adjustments are critical to an engine; if done incorrectly, the engine will bend all valves	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills	A. Measurement B. Decimals C. Metric conversion		A. The student will be able to demonstrate an ability to clean, lubricate and properly assemble a reconditioned cylinder head B. The student will be able to demonstrate an ability to properly assemble an O.H.C. cylinder head and adjust valves with a moderate level of skill

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Wash and prepare all lower engine components for assembly, install rings on pistons, inspect new bearings and inspect oil pump gears for proper clearance	A. A clean assembly is most important; it should be performed in a clean area, cleaning cloths should be lint free and a good grade engine oil is used for assembly B. A ring installer must be used to put rings on a piston to avoid scratches to the piston C. New bearings must be checked for damage prior to assembly to avoid engine failure D. New oil pumps must be checked for proper gear clearance to avoid a low oil pressure situation	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction			The student will be able to demonstrate an ability to wash and prepare all lower engine components for assembly with a moderate level of skill
II. Install bearings A. Install cam bearings, check for proper camshaft fit B. Install main bearings and crankshaft, check for proper oil clearance and crankshaft end play	A. Oil clearance in all bearings is the most important part of assembly; all moving parts ride on oil, to little clearance will cause an engine to seize and to much clearance will cause a low oil pressure condition B. To properly check main bearing clearance, a test with plasti-gague must be performed	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Decimals C. Measurement D. Torque E. Metric conversion		A. The student will be able to demonstrate an ability to install cam bearings with a moderate level of skill B. The student will be able to demonstrate an ability to install a crankshaft and main bearing testing for proper oil clearance to within .0005 (½ thousand) during a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
III. Install pistons and rods, oil galley plugs and camshaft in an engine	A. A proper order of events must be followed when assembling an engine to insure that no small parts are missing B. Pistons and rods are assembled by manufacturers' direction; this method is universal C. Oil galley plugs are installed and sealed at this point, as their location can not be found after further assembly D. Connecting rod side clearance is checked to insure that there is no connecting rod bind which will cause extensive damage to the rods	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Decimals C. Torque D. Measurement E. Metric conversion	A. Heat - expansion occurs with all internal engine components, therefore, proper clearance between all moving parts must be maintained B. Friction - pistons and rings create a great amount of friction and heat by rubbing the cylinder walls; the heat of expansion must be considered to prevent the friction from becoming to great	The student will be able to demonstrate an ability to install pistons and rods, galley plugs and camshaft providing proper oil and cylinder wall clearance to within .001 inch (one thousand) during a performance test
IV. Install timing chain and gears, balance shafts (diesel) and show proper camshaft to crankshaft timing, degree camshaft to manufacturers' specifications	A. Camshaft to crankshaft timing is of great importance to insure against engine failure B. To degree a camshaft in a gas or diesel engine, maintains that the manufacturer has properly built the camshaft for maximum power and efficiency	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Decimals C. Metric conversion D. Torque E. Geometry F. Degree wheel	Heat - in a diesel engine, improper installation of the camshaft will lessen compression, therefore, not allowing enough combustion heat to properly run the engine	A. The student will be able to demonstrate an ability to install timing chain and gears with a moderate level of skill B. The student will be able to demonstrate an ability to check the camshaft to crankshaft relation with a degree wheel with a level of skill of + or - one degree during a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
V. Replace the oil pump, drive gears pan and covers and install gaskets and seals to insure against leaks which could damage the assembly	A. Oil pump and drive gears must maintain a proper clearance to insure against a low pressure problem B. Gaskets and seals themselves must also be sealed to prevent a loss of oil during the engine running which could do extensive damage to the lower engine assembly	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Torque B. Measurement C. Metric conversion	Chemical reaction - most sealers used in an engine assembly are aeromatic type; when they are exposed to outside air, they will cure forming a tight and leak-proof seal	A. The student will be able to install and inspect the oil pump and drive gears with a moderate level of skill B. The student will be able to demonstrate a knowledge of sealing the lower engine against leaks using the various types of gaskets and sealers with a moderate level of skill during a performance test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Install cylinder heads, push rods and rocker arms	A. Cylinder head installation is critical to the engine as it gives strength to the upper block, holding it together B. Water and oil must pass from the block to the cylinder head; therefore, proper sealing must be maintained C. Push rods and rocker arms are subject to galling during initial start up and must be properly lubricated and adjusted	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Decimals C. Metric conversion D. Torque E. Measurement F. Geometry	Metallurgy 1. Knowledge of different types of fasteners used in high stress situations; therefore, bolts of proper tensile strength are critical 2. Different metals react to each other in different ways; a mechanic must be aware of this during an assembly	A. The student will be able to demonstrate a knowledge of cylinder head installation showing proper bolt selection and torque B. The student will be able to demonstrate the proper procedure for push rod and rocker arm installation and adjustment with a moderate level of skill
II. Install intake and exhaust manifolds and accessories	A. Manifolds and accessories are the last step of assembly; they must be perfectly clean and properly installed to insure against an improper running engine B. The runners of an intake manifold must be checked for loose casting particles that could enter the cylinders on start up C. Any accessories which are installed (such as injectors or carburetors), should be tested prior to installation on a new engine	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Torque B. Measurement C. Metric conversion	Metallurgy 1. Knowledge of different types of fasteners used in high stress situations; therefore, bolts of proper tensile strength are critical 2. Different metals react to each other in different ways; a mechanic must be aware of this during an assembly	A. The student will be able to demonstrate a knowledge of proper manifold installation showing proper bolt selection and sealing with a moderate level of skill B. The student will be able to demonstrate the procedure for accessory testing prior to installation on a new engine

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Upon completion of an assembly, several checks must be made to insure that run-in time of a new assembly will be uninterrupted	A. Oil and coolant levels are checked to insure proper amounts have been added B. Manual priming of oil system to be performed to guard against dry start which could do considerable damage C. Ignition or injector pump timing (diesel) must be pre-set so engine will start quickly to avoid damage to the camshaft and valve train D. Fuel system (gas or diesel) must be manually primed to acquire a quick start	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Volume measurement B. Ratios C. Metric conversion		The student will be able to demonstrate an ability to perform all pre-start engine checks to achieve a moderate level of skill

TOPIC: POST START CHECKS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Perform the necessary post start engine and fuel system checks	A. The initial break-in period of an engine is critical B. The engine oil and cooling system must be checked for leaks which can cause engine failure C. After engine run-in period, cylinder heads must be retorqued to insure a proper seal D. Valve trains will expand during run-in, therefore, readjustment is necessary on a hot engine E. All fittings and fuel system lines must be re-tightened do to expansion heat	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Pressure B. Volume	Heat 1. All materials within the engine expand with the heat of combustion 2. The engine builder must be aware of this as adjustments differ cold to hot	The student will be able to perform all necessary post start-up engine and fuel system checks with a moderate level of skill

UNIT: DYNO TESTING

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Mount and test run an engine on the dynomometer for horsepower, torque and fuel management	A. Many diesel and truck engines require extensive work to install them; an engine which will not produce the proper ratings upon installation will mean a tremendous loss of labor to the engine builder B. Torque, brake horsepower and fuel management are areas of testing to insure the engine will produce the work load C. All work load forces can be changed and monitored on a dyno, but this is extremely difficult in the vehicle	A. Functional reading skills B. Vocabulary C. Parts of textbook/manual D. Following directions E. Outlining and note taking F. Test taking skills G. Writing skills H. Spelling I. Oral communication J. Study skills K. Fact/Opinion distinction	A. Whole numbers B. Decimals C. Metric conversion D. Volume E. Pressure F. Ratios	A. Heat B. Friction C. Pressure D. Metallurgy	The student will be able to demonstrate an ability to install and test run an engine and making and recording system changes with a moderate level of skill during a performance test